



Project Abstract

Integrating Risk Analysis and Risk Communication

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Overall Mission/Objective

The project aims to develop and apply the emerging methodology of *integrated assessment* to using the social, behavioral, and economic sciences in addressing complex social problems. The approach recognizes that formal models provide a unique form of insight into complex, unfamiliar settings. In order to be trustworthy guides, such models must be “behaviorally realistic.” They must reflect current science about the focal behaviors and capture the substance and extent of expert judgment. If they achieve such realism, these models can then serve as templates for targeted risk communication instruments. The approach aims to extract the most relevant science and assemble it into the disciplined structure of an integrated assessment (an interdisciplinary assessment that simultaneously considers different domains of a problem and their feedbacks and interactions). Throughout the assessment development process, communication with the target audience ensures that the analysis is relevant to their concerns, its assumptions transparent to their view, and its results understood, in terms of their implications and robustness.

The need for behaviorally realistic analysis arises in many domains. This project is pursuing such analysis in the context of three relatively unrelated risk domains: (a) radiological emergencies, (b) adolescents’ safety and violence, and (c) animal vectors spreading disease to humans. These domains include risks of more commonly experienced forms (e.g., waste disposal, bullying) as well as events associated with terrorism. This research considers one case study within each of these three domains, each corresponding to terror-related threats. In addition to their timeliness and public interest, these domains have features that stretch the methodology: They can evoke powerful emotions. They require contributions from multiple disciplines. They often raise difficult value tradeoffs. Their complexity and unfamiliarity defy simplistic communication strategies. The focus on specific problems allows selecting results that really matter, from the wealth of research that any field could potentially contribute.

Working out the interfaces between domains can be challenging, in ways that advance the participating disciplines. As an exercise in *applied basic* research, integrated assessment tests existing theories, by seeing how well they perform in new contexts, as requiring the development of auxiliary assumptions, interpreting theories in context, so that they can be tested at all. As an exercise in *basic applied* research, the process can identify new theoretical problems, different than those that might have developed endogenously, through normal scientific evolution.

Progress and Preliminary Outcomes

(1) Radiological emergencies. The 25th anniversary of the Three Mile Island accident recently brought occasion to reflect on the severe social and economic impacts that radiological



emergencies can have, even when radiological health damage is not detectable. As the U.S. fleet of commercial nuclear power plants continues to age, and as the era of terrorism opens new possibilities for large releases of radiation, it is prudent to examine the radiological emergency from a broad behavioral perspective. Similar questions arise whether it's another nuclear power plant accident or a terror-inspired attack with a radiological dispersion device. In the immediate aftermath of the event, how well will officials understand their situation and communicate it to first respondents, healthcare officials, the news media, and residents? How will citizens respond, in order to protect themselves, their families, their homes and businesses? What contamination levels will they accept in choosing to return to homes or workplaces following an evacuation? What factors influence the ability of citizens to trust official information on the extent of radiological contamination? Managing this risk includes modeling the physical processes associated with dispersal of radioactive materials, as well as the cognitive processes of both officials and citizens. To explore this risk management problem in detail, we are conducting an integrated assessment of a radiological terror event in an urban area. This case study requires a strong engineering basis for including both elements of short-term reaction (including communication and behavior), and long-term clean-up decisions.

In addition to representing relevant factors of a radiological dispersion device, such as the type and amount of radioactive material, the weather conditions contributing to spread of radioactivity, and relevant human behaviors, this event is also compared to other possible radiological attacks such as potential explosions around or near waste materials. Comparisons include current and potential barriers to terrorist actions, short-term and long-term impact on population health, and psychological impact of terror events.

(2) Adolescents' Safety and Violence. All people face threats to their personal safety. These threats often exact a price even when they do not occur, by imposing stress and costs for protective measures (including restricted action). Sexual assaults are one such class of threats. Adolescent violence is another, restricting teens' activities, limiting their ability to concentrate on school and work, constraining social relations, and troubling parents. Although adolescents are often perceived as viewing themselves as invulnerable to risk, emerging evidence shows them to be similar to adults or even possessed of special vulnerability to premature death. School shootings are low-probability, high consequence events, seemingly on the mind of many teens and adults concerned with their welfare. We are continuing to refine an integrated assessment of these threats, as they vary by school and are affected by preventive measures such as metal detectors on school grounds and psychological profiling of students, as well as parent reactions to the threats including changes of school venue or transportation. That assessment, and the subsequent communications, deals with complex social and emotional processes, as well as high levels of uncertainty.

We are currently subjecting our integrated assessment to ongoing scrutiny from various experts to further refine the defined variables and their relationships to one another. Next we will embark on a thorough analysis of the existing literature on school violence, including psychological and physical, representing all known correlational and causal relationships in terms of our integrated assessment. This step will further inform the assessment and will provide a rubric for integrating diverse findings on school violence into an integrated tool that will allow the review to present



more than the sum of the individual studies.

(3) Zoonotic risks. Many diseases spread from animals to humans, including relatively new ones such as SARS, West Nile, and Avian flu. They represent possibly severe threats to health and security, if they begin to spread more easily in the human population. For this project, we will take, as a prototype, intentionally released bubonic plague spread through fleas on rodents and domestic animals. This scenario is not beyond imagination. During World War II, the Japanese army air-dropped clay containers of plague-infected fleas and grain to attract local rodents over China, thereby condemning thousands of civilians to a gruesome death. Bioterrorism incidents can create severe psychopathology, making the task of communicating clear instructions to the public, who are frightened for the safety of their children and terrified of their pets, a delicate one. Effective communication could provide a form of psycho-prophylaxis. Our integrated assessment combines biological and behavioral science in a general form, adaptable to a variety of mammal-flea complexes, to identify critical choices and informational needs from both the institutional and individual perspectives.

The integrated assessment models a hypothetical release of plague at a crowded stadium, following likely sequelae at multiple levels. It distinguishes between different forms of plague, including bubonic (transmissible from flea bites), pneumonic (transmissible through coughing) and sylvatic (transmission between wild animals). It incorporates what is known about the biological mechanisms of the disease with anticipated and varied public and government reactions.

Broader Impacts

This research is expected to have broad impacts. Combining these diverse, interdisciplinary approaches, across these three critically important risk domains, the research team will produce an enhanced version of integrated assessment, documented in such a way as to promote other researchers using it and applying it to other domains. Our research team's collaborative approach will allow us to address new, emerging risks in an innovative fashion, and formulate a detailed plan for addressing such risks in these and other domains as they arise.

Project-Related Website

<http://sds.hss.cmu.edu/risk/>